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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
08/916,629	08/22/1997	CHAD A. COBBLEY	97-0098	3496

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EXAMINER

AFTERGUT, JEFF H

ART UNIT	PAPER NUMBER
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1733

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/24/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

08/916,629

Applicant(s)

COBBLEY ET AL.

Examiner

Jeff H. Aftergut

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 April 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 and 40-44 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22 and 40-44 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application
- ☐ Other: _____

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
2. Claims 1-20 and 42-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Krall in view of Chorbadjiev et al, the admitted prior art, either one of Loctite 410 or Loctite 416 and either one of Zwick or PCT WO 07/06953 and optionally further taken with the state of the prior art as exemplified by at least one of Liang et al, Fogal et al, Farnworth, Davis, and German Patent 4107347.

Krall taught that it was known at the time the invention was made in the art of manufacturing electronic microchips to utilize methyl cyanoacrylate or other cyanoacrylates as an adhesive for joining contact leads to chips. Since the major failure mode of chips occurs at the chip lead interface, it would have been advantageous if such cyanoacrylate adhesives were radiopaque so that the weld could be examined, see column 1, lines 42-53. Clearly, it was known at the time the invention was made to utilize a cyanoacrylate adhesive to join the contact leads of a leadframe to a chip. The reference failed to make mention of the speed with which the cyanoacrylate adhesive cured in the operation. The reference additionally failed to teach that one skilled in the art at the time the invention was made would have employed a die attach mechanism to assemble the die to the leadframe wherein the same included aligning mechanisms to ensure proper alignment of the chip to the leadframe as well as a vacuum tool for manipulating the die and a dispensing means for application of the adhesive

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upon the leadframe or die. It should be noted that some means must have been provided for in the manufacture of a die on leadframe assembly, however the reference to Krall is silent as to the nature of the same.

In the art of manufacturing electronic components (such as the attachment of a chip to leads), the reference to Chorbadjiev et al (the article entitled "The effect of fillers upon properties of electroconductive cyanoacrylate adhesives" from the International Journal of Adhesion and Adhesives, July 1988) suggested that cyanoacrylate adhesives when compared to traditional epoxy adhesives had the following strong points: (1) short setting time at room temperature; (2) one component adhesives; (3) strong bonding action; (4) easy to work with, and; (5) satisfactory electroconductivity of adhesive bonds. It should be noted that the reference to Chorbadjiev et al is concerned with the manufacture of an electroconductive adhesive material (which is was one would have utilized to join the chip to the leads in Krall). The reference clearly suggested that the curing times would have been short with cyanoacrylate and additionally provided additional reasoning as to why those skilled in the art at the time the invention was made would have selected cyanoacrylate adhesives for the bonding of the chip to the lead of the leadframe. The reference, nonetheless, did not expressly state that the material would have cured in less than one minute at room temperature (20-30 degrees C) to between 90-100% crosslink density (polymerization). Additionally, the reference is silent as to the systems employed to attach the die to the leadframe (whether employing cyanoacrylate adhesive or epoxies).

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However, the applicant has repeatedly admitted that the cure times are intrinsically a property of cyanoacrylate adhesives (see page 11, of the response dated 9-12-2001 in child patented file Serial Number 09/274,128, for example):

“In this regard, Applicant would submit that although cyanoacrylate adhesives and anaerobic adhesives, which are formulated to cure in less than sixty seconds, are known in the art, they have not heretofore been used to construct a semiconductor package as presently claimed.”

Clearly, the quick curing of the adhesive was known per se in the art.

Additionally, those skilled in the art at the time the invention was made would have understood that the die attachment operation would have been performed in a manufacturing environment for high speed productivity wherein such processing would have included the use of the conventional die attachment systems known in the art. Such systems as described by applicant in the specification (admitted as known by appellant) included the use of a leadframe having several paddles for attaching each die to the leadframe (page 2, lines 10-22), a leadframe feed mechanism for manipulating the leadframes, a vacuum tool for manipulating the dice, a dispensing mechanism for applying a desired volume of adhesive to the mounting paddles, an optical alignment device for aligning the dice to the mounting paddles, and a die support platform for placing the dice in contact with the mounting paddles with a required pressure (see page 9, line 22-page 10, line 2 of the specification). Clearly, applicant has admitted that the system for attaching the die to the leadframe was known per se in the art and included the use of the dispenser for depositing the adhesive, an alignment apparatus for properly aligning the die to the leadframe, a vacuum tool for

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manipulating the die and a pressing mechanism to press the die to the paddle of the leadframe. One would have been motivated to employ a cyanoacrylate adhesive in the operation (the device) for the reasons identified by Krall and Chorbadjiev et al.

As evidenced by Loctite 410 and Loctite 416, commercially available quick curing cyanoacrylate adhesives existed which cured within 60 seconds at room temperature to complete cure (100% polymerization). The applicant is referred to the spec sheets of Loctite 410 and Loctite 416 for the specific curing properties achieved with the use of the same. It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a cyanoacrylate adhesive to join leads of a leadframe to a semiconductor chip as such was suggested by Krall wherein the cyanoacrylate adhesive would have been known to have incorporated an electrically conductive filler therein in order to facilitate electrical conductivity whereby such an adhesive had a quick cure time as evidenced by Chorbadjiev et al and wherein the adhesive was known to have had a cure time within less than one minute at room temperature as suggested by the applicant's admitted prior art and either one of Loctite 410 or Loctite 416 wherein the processing for attach the die to the leadframe utilized commercially available and conventional components for facilitating the automated placement of the die to the leadframe as admitted were known by applicant's admitted prior art. The combination of references failed to recognize the specified volume of adhesive applied and the resulting thickness of the adhesive layer in the semiconductor assembly or the specified desirability of forming the same.

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The references to either one of Zwick or PCT '953 suggested that those skilled in the art at the time the invention was made would have understood that for a chip having a size of 5mm by 5mm that the typical thickness of the adhesive after polymerization of the same was 25 microns (or 0.984 mils) wherein the chip was assembled to the leadframe with liquid adhesive droplets and wherein the chip was pressed against the leadframe in the bonding operation, see column 1, lines 23-28 of Zwick and page 1, lines 20-25 of PCT '953. It is clear that one skilled in the art would have desired for a chip size (surface area) of 25 mm² (5mm by 5mm) to have an adhesive layer of a thickness of 0.984 mils. The chip size applicant uses in the specification is 4.4 mm by 9.4 mm (or an area of 41.36 mm²). One would have expected that the volume of adhesive utilized to achieve the thickness of the adhesive for a chip having a surface area of 64% of the surface area of the disclosed chip (i.e. 25mm² is 64% of the size of the chip surface area disclosed) would have fallen within the claimed range as an increased amount would have been applied to obtain the needed coverage for the assembly to provide a spacing of 25 microns for the thickness of the adhesive layer. Additionally, applicant is advised that as the value for the thickness fell within the middle of the range, one would have expected that the amount utilized for the volume of adhesive would have been within the middle of the recited range. Had one reduced this amount by 36% it still would have fallen within the range of weight of material applied to secure the chip upon the leadframe. Applicant is advised that the references to both of Zwick and PCT '953 suggested that those versed in the art would have applied pressure to the

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assembly when attaching the chip to the leadframe wherein the pressure applied was uniform over the entire surface. The applicant is advised that one skilled in the art would have applied the pressure necessary to obtain an adequate bond and good surface contact (as well as spreading of the adhesive material therein). The applicant is advised that one skilled in the art would have known to apply a pressure within the specified range in order to achieve the desired bond and that the claimed range of pressure is taken as conventional in the art of joining a die to a leadframe. As noted above the specific pressure applied is not clearly recited as pressure must be identified as a force per unit area and no area has been identified. As such, the reference by applying force to assemble the components must teach the specified force.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a cyanoacrylate adhesive to join leads of a leadframe to a semiconductor chip as such was suggested by Krall wherein the cyanoacrylate adhesive would have been known to have incorporated an electrically conductive filler therein in order to facilitate electrical conductivity whereby such an adhesive had a quick cure time as evidenced by Chorbadjiev et al and wherein the adhesive was known to have had a cure time within less than one minute at room temperature as suggested by the applicant's admitted prior art and either one of Loctite 410 or Loctite 416 wherein the processing for attaching the die to the leadframe utilized commercially available and conventional components for facilitating the automated placement of the die to the leadframe as admitted were known by applicant's admitted prior art wherein one applied

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pressure and drops of the adhesive in such a manner to yield an adhesive thickness in the finished assembly between 0.2 to 2.0 mils in thickness as suggested by either one of PCT WO 97/06953 or Zwick..

With regard to the various dependent claims, the applicant is advised that the admitted prior art suggested that chip on lead assembly was known per se as well as wire bonding and encapsulating the same. the applicant's disclosed contribution (and the application has been argued as such) to the art was the recognition that cyanoacrylate adhesives would have been useful for joining leads to a chip in the semiconductor art and that no reference suggested the same. The reference to Krall suggested the use of cyanoacrylate adhesives to join a chip to leads of a leadframe. The particular configuration of the semiconductor assembly would have been selected dependent upon the desired demands of the customer and are within the skill level of the ordinary artisan to select (the various chip arrangements and lead arrangements are taken as conventional in the art). The applicant is additionally advised that one skilled in the art would have known to incorporate a filler such as an electrically conductive filler in the resin as suggested by Chorbadjiev et al.

Krall suggested that cyanoacrylate adhesive would have been useful for joining a chip to a lead in the manufacture of a semiconductor package. The reference did not expressly state that the chip was assembled to the leadframe but rather referred to the chip being attached to the leads with adhesive. It should be noted that the reference clearly did not refer to "wire bonding" as addressed by applicant. The reference was silent as to what was meant by chip to lead

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attachment. The applicant is advised that one skilled in the art would have been expected to have basic knowledge of the art and one skilled in the art would have been expected to use common sense and common knowledge from the art, In re Bozek, 163 USPQ 545. The ordinary artisan is presumed to know more than what he reads in the references, he is presumed to have sufficient basic knowledge to apply and combine features of the prior art, In re Sovish, 226 USPQ 771, In re Bode, 191 USPQ 12.

The references to any one of Liang et al, Fogal et al, Farnworth, Davis, and German Patent 4107347 all suggested that one skilled in the art would have known that "wire bonding" was associating a wire between the chip and the leads and that the wire bonding operation did not include the use of adhesive to join the wire to the chip and the lead. Appellant is referred to the drawings of each document. Additionally, each reference suggested that one skilled in the art would have incorporated an adhesive like an epoxy between the chip and/or die and the leadframe at the paddle of the leadframe. In each of these references, this is where the chip and the lead frame interface is taught and where the same is joined with adhesive. The appellant is also referred to the admitted prior art of this application, where the applicant admitted that it was known to join a chip to a leadframe with epoxy adhesive for example, see pages 2-3 of the specification and note that the admitted prior art also suggested that "wire bonding" was in fact a separate and distinct operation from the adhesive bonding operation. Clearly, one viewing the state of the prior art as exemplified by at least one of Liang et al, Fogal et al, Farnworth, Davis, and German Patent 4107347. Certainly, then,

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when one skilled in the art viewed Krall, one skilled in the art would have understood that the operation where adhesive was used would have included the joining of the chip to the paddle of the leadframe (since this is the place where the chip is associated with adhesive in the operation of associating a chip to a lead) with the cyanoacrylate adhesive.

Regarding the newly presented limitations regarding the thermal budget and thermal stresses, the applicant is advised that the prior art expressed above clearly expressed that the cyanoacrylate adhesive would have been used in order to perform the bonding operation at room temperature (without addition of heat to the bonding operation). Clearly, the prior art envisioned the lack of heating in the proposed combination and such lack of heat to cure the arrangement would have resulted in no thermal stresses being induced on the die as well as no addition to the thermal budget of the die.

3. Claims 21, 22, 40 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art in view of either one of Zwick or PCT WO 97/06953 and Japanese Patent 58-196,280.

The admitted prior art suggested that it was known to join a chip to a leadframe with an epoxy adhesive material, see pages 2 and 3 of the specification. Additionally, those skilled in the art at the time the invention was made would have understood that the die attachment operation would have been performed in a manufacturing environment for high speed productivity wherein such processing would have included the use of the conventional die attachment systems known in the art. Such systems as described by appellant in the

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specification (admitted as known by applicant) included the use of a leadframe having several paddles for attaching each die to the leadframe (page 2, lines 10-22), a leadframe feed mechanism for manipulating the leadframes, a vacuum tool for manipulating the dice, a dispensing mechanism for applying a desired volume of adhesive to the mounting paddles, an optical alignment device for aligning the dice to the mounting paddles, and a die support platform for placing the dice in contact with the mounting paddles with a required pressure (see page 9, line 22-page 10, line 2 of the specification). Clearly, applicant has admitted that the system for attaching the die to the leadframe was known per se in the art and included the use of the dispenser for depositing the adhesive, an alignment apparatus for properly aligning the die to the leadframe, a vacuum tool for manipulating the die and a pressing mechanism to press the die to the paddle of the leadframe. The applicant also admitted that anaerobic and cyanoacrylate adhesives were known in the prior art and had been formulated to cure in less than 60 seconds but that the same were not known to have been used to construct a semiconductor package. The applicant did not admit that it would have been useful to provide the specified volume of adhesive to join the chip to the leadframe.

The references to either one of Zwick or PCT '953 suggested that those skilled in the art at the time the invention was made would have understood that for a chip having a size of 5mm by 5mm that the typical thickness of the adhesive after polymerization of the same was 25 microns (or 0.984 mils) wherein the chip was assembled to the leadframe with liquid adhesive droplets and wherein the

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chip was pressed against the leadframe in the bonding operation, see column 1, lines 23-28 of Zwick and page 1, lines 20-25 of PCT '953. It is clear that one skilled in the art would have desired for a chip size (surface area) of 25 mm² (5mm by 5mm) to have an adhesive layer of a thickness of 0.984 mils. The chip size applicant uses in the specification is 4.4 mm by 9.4 mm (or an area of 41.36 mm²). One would have expected that the volume of adhesive utilized to achieve the thickness of the adhesive for a chip having a surface area of 64% of the surface area of the disclosed chip (i.e. 25mm² is 64% of the size of the chip surface area disclosed) would have fallen within the claimed range as an increased amount would have been applied to obtain the needed coverage for the assembly to provide a spacing of 25 microns for the thickness of the adhesive layer. Additionally, applicant is advised that as the value for the thickness fell within the middle of the range, one would have expected that the amount utilized for the volume of adhesive would have been within the middle of the recited range. Had one reduced this amount by 36% it still would have fallen within the range of weight of material applied to secure the chip upon the leadframe. Applicant is advised that the references to both of Zwick and PCT '953 suggested that those versed in the art would have applied pressure to the assembly when attaching the chip to the leadframe wherein the pressure applied was uniform over the entire surface. The applicant is advised that one skilled in the art would have applied the pressure necessary to obtain an adequate bond and good surface contact (as well as spreading of the adhesive material therein). The applicant is advised that one skilled in the art would have known to apply a

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pressure within the specified range in order to achieve the desired bond and that the claimed range of pressure is taken as conventional in the art of joining a die to a leadframe. As noted above the specific pressure applied is not clearly recited as pressure must be identified as a force per unit area and no area has been identified. As such, the reference by applying force to assemble the components must teach the specified force. The combination, nonetheless, failed to recognize that it would have been desirable to utilize an anaerobic adhesive in the operation.

The reference to Japanese Patent '280 suggested that it was known to utilize an anaerobic adhesive to join a chip to leads of a board in the manufacture of a semiconductor assembly wherein the anaerobic adhesive material was an acrylic anaerobic adhesive material. The reference clearly expressed by the translation of the same that the anaerobic adhesive cured in several tens of seconds (which appears to include less than 60 seconds) at a normal temperature (room temperature). Additionally, the abstract suggested that the adhesive would have included filler therein in order to render the adhesive material electrically conductive. It would have been obvious to employ the quick curing adhesives of Japanese Patent '280 in the operation of joining a chip to a leadframe as such use of anaerobic adhesives would have sped up productivity where the processing included the use of conventional die attachment operations such as those admitted by applicant's admitted prior art wherein the volume of adhesive applied was adequate to provide a desired final thickness to the

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adhesive disposed between the chip and the leadframe as taught by either one of Zwick or PCT WO 97/06953.

Regarding the newly presented limitations regarding the thermal budget and thermal stresses, the applicant is advised that the prior art expressed above clearly expressed that the cyanoacrylate adhesive would have been used in order to perform the bonding operation at room temperature (without addition of heat to the bonding operation). Clearly, the prior art envisioned the lack of heating in the proposed combination and such lack of heat to cure the arrangement would have resulted in no thermal stresses being induced on the die as well as no addition to the thermal budget of the die.

Response to Arguments

4. Applicant's arguments filed 4-9-07 have been fully considered but they are not persuasive.

The applicant has amended the claims to recite that there is no addition to the thermal budget of the die and that there is no thermal stress introduced in the die as well as that the polymerization was performed at ambient atmosphere.

The applicant is advised that the claim previously recited that there was no heating of the die and leadframe. What applicant is not claiming is there really, really is no heating of the die and leadframe. It is semantics. The prior art clearly envisioned the use of cyanoacrylate adhesive or anaerobic adhesives to join a chip to a leadframe without the addition of heat in the operation. The Board of Appeals further rendered a decision indicating the same.


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Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeff H. Aftergut whose telephone number is 571-272-1212. The examiner can normally be reached on Monday-Friday 7:15-345 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Crispino can be reached on 571-272-1226. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


Jeff H. Aftergut
Primary Examiner
Art Unit 1733

JHA
April 20, 2007